

Regenerators for Liquid Hydrogen Cryocoolers, Phase II

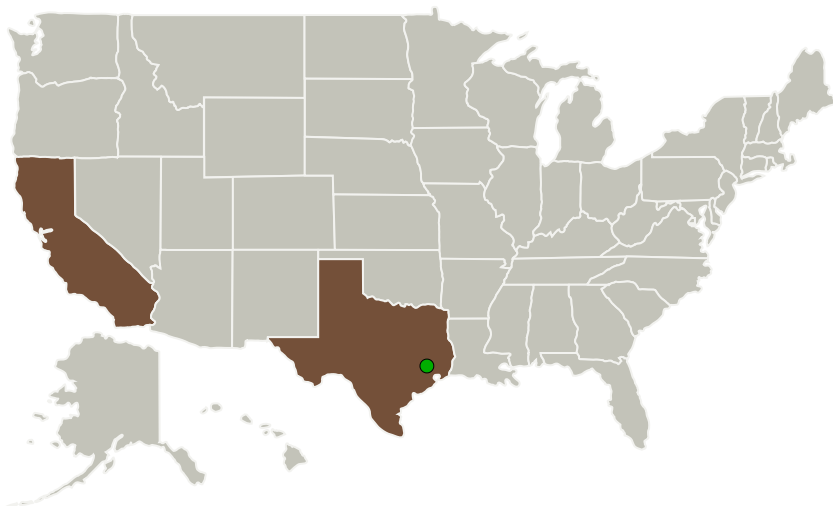
Completed Technology Project (2010 - 2012)



Project Introduction

Future NASA exploration, planetary and astrophysics missions will require various enhancements in multi-stage cryocoolers. These include increased efficiency, reduced vibration and reductions in overall system mass and power consumption. For the small coolers required, pulse tube and Stirling coolers offer the best opportunities. At present, the efficiency of these coolers is limited by the effectiveness of low-temperature-stage regenerators. Below about 60 K, two factors play key roles in reducing the effectiveness of regenerators. One is that the heat capacity of most materials falls rapidly with decreasing temperature, thereby, severely limiting the number of useful materials to a few in common use. A second factor is that these commonly used materials are only available in powder form, a form known to raise reliability issues. In this effort, we will address both factors. We will use newly developed materials with high heat capacities at temperatures below 80 K, higher than that of commonly used materials. Further, we will develop novel low-temperature regenerator matrix configurations that will address both the aspect of high-efficiency and regenerator durability. Both the void fraction and the ratio of surface area to solid fraction of the regenerator matrix will be varied to achieve high efficiency.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Atlas Scientific	Lead Organization	Industry	San Jose, California
● Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
California	Texas

Project Transitions

**February 2010:** Project Start**February 2012:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/139396>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Atlas Scientific

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

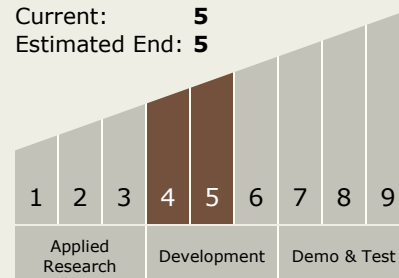
Carlos Torrez

Principal Investigator:

James Maddocks

Technology Maturity (TRL)

Start: 4
 Current: 5
 Estimated End: 5



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Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System